Effect of Focused Attention & Open Monitoring Meditation Practices on Mind Wandering, Cognitive Ability and Event- Related Brain Dynamics of High Schoolers

A

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INTRODUCTION

Children need to perform many cognitive tasks related to learning, paying attention, memory, thinking and problem solving etc. All these tasks are important for better academic performance and scholastic and non- scholastic success of children. These cognitive tasks are directly related to cognitive abilities of children. In order to enhance these cognitive abilities of children it is necessary to provide proper mind and body training to children so that they can perform all tasks better and achieve their educational goals. Practices like meditation, and yoga have positive effects upon mind and body so these practices can also be used in education for proper physical and mental development of students and to reduce academic stress. Recent studies have found that meditation practices, yoga, and physical activities are beneficial to use at school level (Goldschmidt, 2019; Daya, & Hearn, 2017; Waters, Barsky, Ridd, & Allen, 2014; Frango, Manas, Cangas, & Gallego, 2010). But it is necessary to know what kind of meditation practice is beneficial for students. Because students cannot be as extensive as adults, so it is necessary to find a suitable mediation practice which can easily be blend with both their daily lives and educational programme. The present study aims to find out the comparative effect of focus attention and open monitoring types of meditation practices on mind wandering cognitive ability, metacognition and event related brain dynamics of high schoolers.

1.1 CONCEPT OF MEDITATION

Meditation is a mind and body practice that has a long history of use for increasing calmness and physical relaxation, improving psychological balance, coping with illness, and enhancing overall health and well-being. Meditation is a mental training of attention. This involves the selection of goal-relevant information from the array of inputs that bombard our sensory systems (Slagter et al., 2007). Meditation is the process of quieting the mind in order to spend time in thought for

relaxation or religious/spiritual purposes. The goal is to attain an inner state of awareness and intensify personal and spiritual growth. In practice, meditation involves concentrated focus on something such as a sound, image or feeling. All meditation practices, including open awareness practices, involve the cognitive process of monitoring one's attention (Brandemeyer & Delorne, 2018). According to the Webster dictionary, meditation practice consists of "engaging in mental exercise (such as concentration on one's breathing or repetition of a mantra) for the purpose of reaching a heightened level of spiritual awareness."

Meditation is also referred to as dhyana in Sanskrit. According to Online Etymological Dictionary (2019), the word "meditation" is originated from the Latin "meditari," which means, "to engage in contemplation or reflection." Meditation has been characterized in many ways in the scientific literature and there is no consensus definition of meditation. This diversity in definitions reflects the complex nature of the practice of meditation and the coexistence of a variety of perspectives that have been adopted to describe and explain the characteristics of the practice.

Cardoso, De Souza, Camano, & Leite (2004) developed a detailed operational definition of meditation broad enough to include traditional belief-based practices and those that have been developed specifically for use in clinical settings. Using a systematic approach based on consensus techniques, they defined any practice as meditation if it: (i) utilizes a specific and clearly defined technique; (ii) Involves muscle relaxation somewhere during the process; (iii) Involves logic; (iv) A self-induced state; (v) The use of a self-focus skill or "anchor" for attention.

1.2 TYPES OF MEDITATION

Meditation encompasses a family of practices that share some unique and distinct features, but that vary in some vital ways in their purpose, practice and process. Meditation practices have been

categorized based on their nature, effects and aim into two categories (Giovanni 2019; Lutz, Slagter, Dunne, and Davidson, 2008). These categories are as follows:

1.3 FOCUSED ATTENTION MEDITATION (FAM)

Focused attention meditation involves practice of focusing the attention on a single object during the whole meditation session. This object may be the breath, a mantra, visualization, part of the body, external object, etc. According to Raldiris (2017), 'Focused Attention Meditation involves voluntarily sustaining one's attention on a chosen perceptual object (e.g. sensations of breathing), As the practitioner advances, his ability to keep the flow of attention in the chosen object gets stronger, and distractions become less common and short-lived. Both the depth and steadiness of his attention are developed.' Many research studies have found that FA meditation has many physical and mental benefits like more refined attention regulation skills (improved attention during any task (Moye, & Vugt 2017), better focus & high creativity (Lippelt, Hommel, & Colzato 2014). Several EEG studies have found maximum beta and gamma band neural activations during FAM. Gamma activations in brain is linked with increased attention and control over mental processes, blood flow in brain and increased synaptic plasticity. (Lubar, 1997; Singer, 1999; Salinas & Sejnowski, 2001; Stein & Sarnthein, 2000; Niessing, 2005). Several EEG/MEG studies have found that brain areas such as inferior parietal lobule, the superior temporal gyrus, the cingulate cortex, the caudate, and lateral prefrontal cortex areas linked with attention show strong activity signals during FAM practice (Pagnoni, Cekic, & Guo, 2008). Studies have shown that during the of FAM N1, P2 and P3a ERP waves are prolonged (Cahn, Polich, 2009; Telles, Raghavendra, Naveen, Manjunath, Subramanya, 2012, 2013; Telles, Singh, Naveen, Pailoor, 2015, 2016). Samatha (Buddhist meditation), some forms of, Zazen, Loving Kindness Meditation, Chakra Meditation, Kundalini Meditation, Sound Meditation, Mantra Meditation, Pranayama,

some forms of Qigong are examples of FAM. *Surat- Shabd-Yoga* meditation is also one of the types of FAM practice, which is based on the oriental philosophy of saints (Radhasoami Philosophy) (Satsangi, 2011; Sahab, 1909).

1.4 OPEN MONITORING MEDITATION

Open monitoring meditation (OMM) involves broadening of attention to a variety of on-going cognitive events and experiences. Instead of focusing attention on a specific object, it involves awareness and attentiveness towards experiences and events during the meditation. All perceptions be them internal (thoughts, feelings, memory, etc.) or external (sound, smell, etc.), are recognized and seen for what they are. OMM practice is different form FAM practice in terms of distribution of attention. According to Raldiris (2017) 'Open Monitoring Meditation entails broadened, receptive attention to all salient sensory, kinaesthetic, emotional, and cognitive experience from moment to moment'. It is the process of non-reactive monitoring of the content of experience from moment to moment, without going into them. Benefits of OMM includes, increased psychological wellbeing (Singleton et al., 2014), better emotional regulation skills (Holzel et al., 2011) decrement in mental stress (Khoury, Sharma, Rush, & Fournier, 2015), decreased anxiety (Hofmann, Sawyer, Witt, & Oh, 2010) and improved physical health (Creswell et al., 2012). OMM based programmes are also helpful in treating psychological problems like depression (Lenz, Hall, & Smith, 2016), anxiety disorders anxiety disorders (Kim et al., 2009). Many neuroimaging studies have also found that OMM often results activations in theta band. EEG studies conducted on OMM practices reveals high activations in fronto- parietal regions which are associated with attention and metacognitive awareness (Gazzaniga, 1995; Manna, Raffone, Perrucci, Nardo, Ferretti, Tartaro, Romani. 2010; Scheibner, Bogler, Gleich, Haynes, & Bermpohl. 2017). ERP studies on OMM have found that N2 and P3b waves are prolonged during different cognitive tasks performed by

OMM meditators (Norris, Creed, Hendler, & Kober, 2018; Singh, & Telles, 2015; Kaur & Singh, 2015) Examples are: Mindfulness meditation, as well as some types of Taoist Meditation.

1.5 MEDITATION IN EDUCATION

There is a growing interest of researchers and educators to blend meditation and other contemplative practices in educational processes for the benefits that meditation may provide to students as well as teachers (Bush, 2006; Shapiro, Brown, & Astin, 2011) and many studies have found that it is appropriate to integrate simple meditation practices like mindfulness, attention practices in education can be beneficial for students' physical and mental growth (Shapiro, Brown, & Astin, 2011; Goldschmidt, 2019). Because school children cannot be as extensive as adults so only those meditation practices should be included which can easily be integrated with their daily life and education processes. Some recent systematic reviews in the field of education and meditation, that bring all the studies together, have concluded that the results of the work that have taken place are feasible and promising (Burke, 2009; Harnett, & Dawe, 2012). The Consensus is that these meditation-based interventions are generally acceptable, and there have been no any report of them causing harm to any participant or have any adverse side effects of meditation practices. In fact, meditation based complementary therapies can also be used to treat attention disorders and other psychological problems in students. Studies have found that numerous mindfulness based interventions are developed and successfully tested in psychiatry and medical sciences (e.g., mindfulness based stress reduction [MBSR], mindfulness-based cognitive therapy for depression [MBCT], mindfulness-based eating awareness training [MB-EAT] for binge eating, mindfulness training for smokers [MTS] for smoking cessation, mindfulness-oriented recovery enhancement [MORE] for chronic pain and opiate misuse) (Goldberg, Tucker, Greene, Simpson, Kearney, & Davidson, 2017; Davis, Goldberg, Anderso, Manley, Smith, Bake,& 2014; Garland,

Manusov, Froeliger, Kelly, Williams, & Howard, 2014; Kristeller, & Wolever, 2011; Segal, Williams, & Teasdale, 2002). Table 1.0 has summarized many studies on using mindfulness meditation at different levels of education. These studies have found that meditation practices like focus attention and open monitoring and mindfulness are easy to carry out, fir into wide ranges of context, and enjoyable by both students and teachers.

2.0 EMERGENCE & JUSTIFICATION OF THE PROBLEM

Cognitive abilities are important mental skills that play protagonist role in task performance, paying attention, learning, knowledge acquisition, abstract thinking, and problem solving (Carrol, 1992; Gottfredson, 1997; Schmidt & Hunter, 1998). Cognitive abilities are brain based skills which includes information processing in brain, executive functioning, working memory, reasoning ability which are undoubtedly important for each individual because these skills are required by everyone to perform any task especially cognitive tasks or to process information in brain or to solve some problems. If any of these abilities are weak, no matter what kind of information is coming, grasping, retaining, or processing is occurring, it will get affected and will eventually create some problems in cognitive development and increase struggle in task performance and learning.

Deficits in cognitive ability can take form of severe cognitive or behavioural disorders such as attention disorders like ADHD, sluggish cognitive tempo, anxiety disorders, conduct disorders, and intellectual disability (American Psychological Association, 2013; Hatfield, 2019). These problems are increasing rapidly in children especially in high schoolers. High school age is one of the important developmental stages of life. It connects childhood and adulthood, so it is also very important to pay attention to the problems occurring at this stage. At this stage children require

special attention to their growth and development. This is the stage where major physical, hormonal and mental changes occur, so it is necessary to pay attention to their difficulties, struggles and problems etc. On the other hand, Meditation practices change the outlook of a person towards life and whole universe. Many research studies have shown that meditation practices positively affect our conscious experiences, brain functioning, awareness, emotions and selfhood (Ahuja, 2014; Travis, Valosek, Konrad, Link, Salerno, Scheller, Nidich, 2018; Srinivasan. 2019; Borquist. 2019). Therefore, meditational practices and meditation-based teaching learning approaches should be exposed to students and pupil teachers and on other levels of education in order to bring desirable behavioural, psychological and physiological changes and developments in students. Meditational practices can also be used for benefits for teaching and non-teaching staffs. Many clinical studies have also proved that meditational practices and therapies are really beneficial as the complementary treatment of patients suffering from attention disorders, post-traumatic stress disorders, Concentration disorders, anger problems, depression, and anxiety. Many researches have shown the evidences that meditation practices have positive effect on mind and body. And many neuroscientific researches have confirmed that meditation does have positive effect on brain and cognitive processes. Meditation reduces stress, controls anxiety, enhances self-awareness, increases attention span, boosts memory, increases empathy, induce the quality of sleep, controls blood pressure (Goyal, Singh, Sibinga, Gould, Rowland, Sharma, Berger, Sleicher, Maron, Shihab, Ranasinghe, Linn, Saha, Bass, Haythornthwaite. 2014; Carmody, & Baer. 2008; Dahl, Lutz & Davidson. 2015; Jha, Krompinger & Baime. 2006). Table 1.0 is consisted of the studies conducted on different meditation practices in education.

Table 1.0 Research studies on Different meditation practices in Education

Authors	FAM/ OMM/ COMB.	Title of the study
Baranski & Was, (2019)	OMM	Can Mindfulness Meditation Improve Short-term and Long-term Academic Achievement in a Higher-education Course?
Carpena, Tavares, & Menezes, (2019)	FAM	The effect of a six-week focused meditation training on depression and anxiety symptoms in Brazilian university students with 6 and 12 months of follow-up
Campos et al, (2019)	OMM	Exploring the Role of Meditation and Dispositional Mindfulness on Social Cognition Domains: A Controlled Study
Klimes et al, (2019)	FAM	Transcendental meditation and hypothalamic-pituitary-adrenal axis functioning: a pilot, randomized controlled trial with young adults
Deans, (2019)	FAM	Quiet Time based on Transcendental Meditation
Graham & Truscott, (2019)	FAM	Exploring mystery: can Christian meditation at school nurture students' relationships with God?
Kudesia, (2019)	OMM	Mindfulness as Metacognitive Practice
Patton et al, (2019)	OMM	Additive effectiveness of mindfulness meditation to a school-based brief cognitive-behavioural alcohol intervention for adolescents
Sapthiang, Gordon, & Shonin, (2019)	OMM	Mindfulness in Schools: a Health Promotion Approach to Improving Adolescent Mental Health
Shadiev & Huang, (2019)	OMM	Investigating student attention, meditation, cognitive load, and satisfaction during lectures in a foreign language supported by speech-enabled language translation
Strickland & Salwyn, (2019)	OMM	Effects of a Short Mindfulness Meditation on Cognitive Function
Valosek et al, (2019)	FAM	Effect of Meditation on Social-Emotional Learning in Middle School Students
Wilson, (2019)	OMM	Improving Behaviour by Implementing In-School Meditation/Mindfulness Interventions.
Woodward, (2019)	OMM	Teacher Perceptions of Mindfulness Implementation in Public Schools

Bazzano, Anderson, haylton, & Gustat, (2018)	OMM	Effect of mindfulness and yoga on quality of life for elementary school students and teachers: results of a randomized controlled school-based study
Greenberg et al, (2018)	OMM	Reduced interference in working memory following mindfulness training is associated with increases in hippocampal volume
Albrecht, (2018)	OMM	Responsibility for nurturing a child's wellbeing: teachers teaching mindfulness with children
Pradhan, (2018)	COMB.	A study of the effect of vipassana meditation on Psychological Well Being of employees and impact of demographic factors on meditation outcome
Daya, & Hearn, (2018)	OMM	Mindfulness interventions in medical education: A systematic review of their impact on medical student stress, depression, fatigue and burnout
Hj Ramli, Alavi, Mehrinezhad, & Ahmadi, (2018)	OMM	Academic Stress and Self-Regulation among University Students in Malaysia: Mediator Role of Mindfulness
Harne & Hiwale, (2018)	FAM	EEG Spectral Analysis on OM Mantra Meditation: A Pilot Study
Lin & Mai, (2018)	OMM	Impact of mindfulness meditation intervention on academic performance
Lynch et al, (2018)	FAM	Mantra meditation for mental health in the general population: A systematic review.
Mori, (2018)	OMM	The Effect of Mindful Practices on the Independent Learning Process of Third-Grade Montessori Students
Weare, (2018)	OMM	The evidence for mindfulness in schools for children and young people
Galante, et al (2017)	OMM	A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial
O'Driscoll, Byrne, Mc Gillicuddy, Lambert, Sahm, (2017)	OMM	The effects of mindfulness-based interventions for health and social care undergraduate students - a systematic review of the literature
Maynard, Solis, Miller & Brendel, (2017)	OMM	Mindfulness-based interventions for improving cognition, academic achievement, behaviour, and socioemotional functioning of primary and secondary school students
Slaviero, (2017)	COMB.	The Impact of Guided Meditation on Children's Behaviour, Mental Health and Well-being
Wisner, (2017)	OMM	Mindfulness and Meditation for Adolescents in Educational Settings
Bezanson, (2016)	OMM	Effects of Meditation on Learning Ability and Cognitive Functioning: A Systematic Review

Campos et al, (2016)	OMM	Mindfulness-oriented meditation improves self-related character scales in healthy individuals
Franco, Manas, Cangas, Gallego, (2016)	OMM	The Applications of Mindfulness with Students of Secondary School: Results on the Academic Performance, Self-concept and Anxiety
Joice, (2016)	FAM	Interventions to Improve Cognitive Interventions to Improve Cognitive Function and Academic Performance of Medical Students
Karunananda, Goldin & Talagala, (2016)	OMM	Examining Mindfulness in Education
Keating, (2016)	FAM	Children's spirituality and the practice of meditation in Irish primary schools
Xu et al, (2016)	OMM	Relation of perceptions of educational environment with mindfulness among Chinese medical students: a longitudinal study
Spadaro & Hunker, (2016)	OMM	Exploring The effects of an online asynchronous mindfulness meditation intervention with nursing students On Stress, mood, And Cognition: A descriptive study
Wimmer, Bellinggrath & Stokhausen, (2016)	OMM	Cognitive Effects of Mindfulness Training: Results of a Pilot Study Based on a Theory Driven Approach
Ching, Koo, Tsai, & Chen, (2015)	OMM	Effects of a Mindfulness Meditation Course on Learning and Cognitive Performance among University Students in Taiwan
Wendt et al, 2015	FAM	Practicing Transcendental Meditation in High Schools: Relationship to Well-being and Academic Achievement Among Students
Waters, Baski, Ridd & Allen, (2015)	OMM	Contemplative Education: A Systematic, Evidence-Based Review of the effect of Meditation Interventions in Schools
Black & Farnando, (2014)	OMM	Mindfulness Training and Classroom Behavior Among Lower-Income and Ethnic Minority Elementary School Children
Eberth, Sedlmeier, (2014)	OMM	The Effects of Mindfulness Meditation: A Meta-Analysis
Ramsburg & Youmans, (2014)	FAM	Meditation in the Higher-Education Classroom: Meditation Training Improves Student Knowledge Retention during Lectures
Saltzman, (2014)	OMM	A Still Quiet Place: A Mindfulness Program for Teaching Children and Adolescents to Ease Stress and Difficult Emotion

Note. FAM= Focused Attention Meditation, OMM= Open Monitoring Meditation, COMB. = Combination of Focused Attention meditation (FAM) & Open Monitoring Meditation (OMM).

Many researchers and educators tried to integrate meditation in teaching learning process or in Education. But this is still a question of reasoning that which meditation is best to include in educational processes? Which meditation practice is more appropriate to use in education to fulfil the needs of students? Though many other researchers have made efforts to evaluate the impact of different meditation practices but majority of them have studied open monitoring meditation, and its impact, especially the impact of mindfulness meditation-based interventions on students. Though efforts have been made but more work needs to be done to identify impact of other meditation practices on students. In the light of fulfilling existing research gap the present aim to address following questions. First, what will be the comparative effect of focus attention (FA) and open monitoring (OM) types of meditation practices on mind wandering, cognitive ability metacognition and Event related brain dynamics of high schoolers? What will be the effect of FAM and OMM practices on mind wandering, cognitive ability metacognition and Event related brain dynamics of high schoolers? How meditation practices will affect their mind and body? Will the effect of meditation practices last for longer time? What will be the effect of these meditation practices on event related brain dynamics of high schoolers? What will be the comparative effect of FAM and OMM practices on mind wandering, cognitive ability and event related brain dynamics of high schoolers? So, the present study will be conducted to find out answers of these questions with appropriate evidentiary support.

3.0 RESEARCH QUESTIONS

1. What will be the effect of FAM practice on mind wandering, cognitive ability, and Event related brain dynamics of high schoolers?
2. What will be the effect of OMM practices on mind wandering, cognitive ability, and Event related brain dynamics of high schoolers?

4.0 STATEMENT OF PROBLEM

Effect of focused attention and open monitoring types of meditation practices on mind wandering, cognitive ability, and event- related brain dynamics of high schoolers.

5.0 OPERATIONAL DEFINITION

Focused Attention Meditation (FAM)

In the present study, under category of FAM, Surat- Shabd- Yoga meditation will be studied, in which the practice of first stage of meditation based on Oriental Philosophy of Saints (Radhasoami Philosophy) will be studied. The practice involves the repetition of sound Ra-dha-soa-mi at four chakras navel, heart, throat and eye centre respectively (Satsangi, 2011). According to Sahab (1909), 'the objective of this training is to achieve higher concentration through sound practice. Repetition and contemplation are performed and practiced on spirit centre of four chakras.' The attention on repetition of sound practice is emphasized in this meditation practice. This type of meditation will be included to study Focused Attention Meditation for present research.

Open Monitoring Meditation (OMM)

In the present study, under category of OMM, mindfulness meditation will be studied. Mindfulness meditation involves various attention practices, including the ability to sustain and focus one's attention. According to Nyhus, & Engel (2019) 'mindfulness meditation involves a course of guided breath awareness, sitting meditation which includes becoming aware of automatic or unintentional thoughts or feelings and letting these distractions pass.' Present study will examine mindfulness meditation according to the perspective of Nyhus & Engel (2019).

Mind Wandering

Mind wandering is the state of involving in spontaneous thoughts, daydreaming, or divided attention, which may affect task related performance and work efficiency (Tang, 2017). The present study will examine mind wandering according to the perspective of Tang (2017).

Cognitive Ability

Cognitive ability is a general mental capacity involving attention skills, executive functioning, task performance. (Gottfredson, 1997; Ispas, & Borman, 2008; Healy, & Hurly, 2003; Hansen, & Ulrey, 2009; Liu, 2015; Niileksela, & McGrew, 2016). The present study will examine cognitive ability according to the perspectives of Gottfredson, 1997, Ispas & Borman (2015), Healy, & Hurly (2003), Hansen, & Ulrey (2009) Liu, (2015), and Niileksela, & McGrew (2016).

Event Related Brain Dynamics

Event-related brain dynamic are the measured brain response that is the direct result of a specific sensory, cognitive, or motor event. Penny, Kiebel, Kilner, & Rugg, (2002) defines ERBD as the 'stimulus induced changes in ongoing brain dynamics.' Event related potentials or event related fields are evoked changes in brain due to a wide variety of sensory, motor or cognitive event. They are EEG/ MEG changes that are time locked to sensory, motor or cognitive events that provide safe and non-invasive approach to study psychophysiological correlates of mental processes (Sur and Sinha, 2009). The MEG equivalent of EEG's event related potentials (ERPs) are event related field (ERFs). The present study will examine Event related brain dynamics according to the perspectives of Penny, Kiebel, Kilner, & Rugg, (2002).

6.0 OBJECTIVES OF THE STUDY

Objective 1: To study the effect of focused attention meditation on mind wandering of high schoolers.

Objective 2: To study the effect of open monitoring meditation on mind wandering of high schoolers.

Objective 3: To study the effect of focused attention meditation on cognitive ability of high schoolers.

Objective 4: To study the effect of open monitoring meditation on cognitive ability of high schoolers.

Objective 5: To study the effect of focused attention meditation event- related brain dynamics on of high schoolers.

Objective 6: To study the effect of open monitoring meditation on event- related brain dynamics of high schoolers.

Objective 7: To study the comparative effect of focused attention and open monitoring meditation practices on mind–wandering of high schoolers.

Objective 8: To study the comparative effect of focused attention and open monitoring meditation practices on cognitive ability of high schoolers.

Objective 9: To study the comparative effect of focused attention and open monitoring meditation practices on event- related brain dynamics of high schoolers.

7.0 HYPOTHESES OF THE STUDY

The following hypotheses were formulated in accordance with the objectives of the study-

$H_0$1. There is no significant effect of focused attention meditation on mind–wandering of high schoolers.

$H_0$2. There is no significant effect of focused attention meditation on cognitive ability of high schoolers.

$H_0$3. There is no significant effect of focused attention meditation on event related brain dynamics of high schoolers.

$H_0$4. There is no significant effect of open monitoring meditation on mind–wandering of high schoolers.

$H_0$5. There is no significant effect of open monitoring meditation on cognitive ability of high schoolers.

$H_0$6. There is no significant effect of open monitoring meditation on event related brain dynamics of high schoolers.

$H_0$7. There is no significant difference between the effect of focused attention and open monitoring meditation practices on mind–wandering of high schoolers.

$H_0$8. There is no significant difference between the effect of focused attention and open monitoring meditation practices on cognitive ability, of high schoolers.

$H_0$9. There is no significant difference between the effect of focused attention and open monitoring meditation practices on event related brain dynamics of high schoolers.

*8.*0 VARIABLES OF THE STUDY

Table 2.0 includes the variables of the present study.

Table 2.0 Variables of the study

	Types of Variables	Name of Variables
1.	Independent variable	Focused Attention Meditation, & Open Monitoring Meditation
2.	Dependent variable	Mind wandering, Cognitive ability, Metacognition, Event-Related brain dynamics

9.0 DELIMITATIONS OF THE STUDY

- The present study will be conducted on a sample of 90 students of high school level.
- The study will be delimited to the students of D.E.I. Prem Vidyalaya and R.E.I., Dayalbagh, Agra.
- Under the category of Focused attention meditation practice, *surat-shabd-yoga* meditation will be studied.
- Under the category of open monitoring meditation practice, mindfulness meditation will be studied.
- For the assessment of cognitive ability, different cognitive abilities like executive functions (inhibitory control and working memory), information processing and cognitive flexibility will be assessed using cognitive tests like Eriksen Flanker test (response inhibition), Stroop test (inhibition), Working Memory n- Back Test (executive functioning), and PASAT Speed Run Test (information processing and cognitive flexibility).

10.0 RESEARCH PROCEDURE

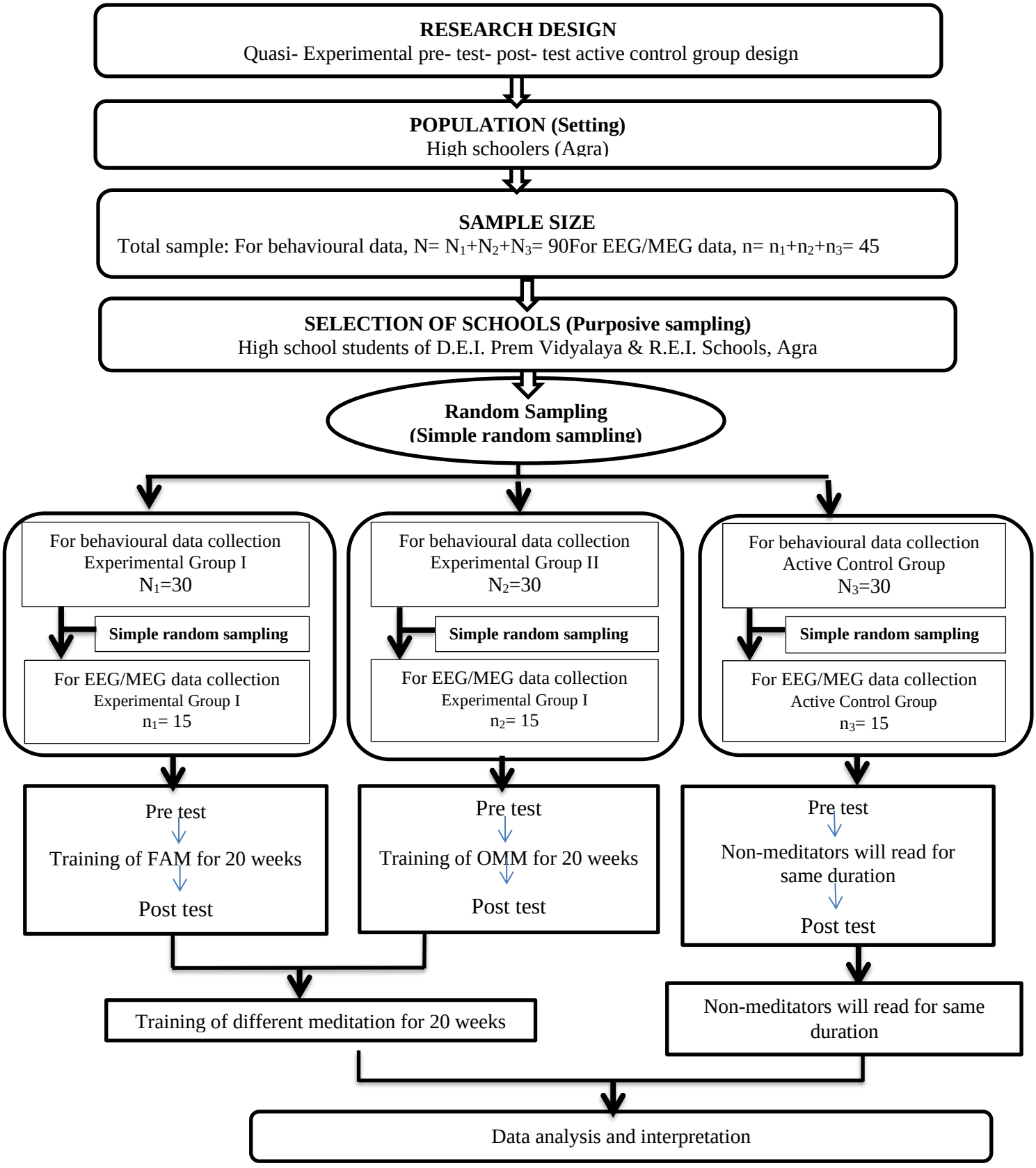

Fig.1: Research Design

11.0 METHOD OF THE STUDY

Quasi- Experimental method will be adopted by the researcher to find out the effect of FAM and OMM practices on mind–wandering, cognitive ability, metacognition and event related brain dynamics of high schoolers.

12.0 SAMPLE

Sample selection procedure in the present study will be done into two stages:

1. Sample selection for behavioural data analysis
2. Sample selection for EEG/MEG data analysis

In the sample selection for behavioural data analysis, 90 high school students will be selected using simple random sampling (Girls: 45, Boys: 45; Experimental Group I: 30 subjects, Experimental Group II: 30 subjects, Active Control Group: 30 subjects). The subjects will be selected using lottery method. The proposed sample size is in accordance to the power analysis by Cohen (1992), which mentions that in the experimental or quasi-experimental studies, where three groups are to be compared, sample size of 30 for each group is sufficient to prove the hypotheses effectively.

EEG/MEG is a scientific endorsement. It helps in determining changes in brain activity. These changes in brain activity do not vary in individuals. However, to ensure consistency of the results it is preferred that at least 20 subjects to be taken as sample for the study (Braboszcz, Cahn, Levy, Fernandez & Delorme (2017); Kaur and Singh (2015); Grandchamp, Braboszcz & delorme (2014); Cahn, and Polich (2006)) Hence, EEG/MEG data analysis will be done on at least 50% of the sample selected for behavioural data analysis i.e. 45 subjects (Experimental Group I: 15 subjects, Experimental Group II: 15 subjects, Active Control Group: 15 subjects).

13.0 PROCEDURE OF THE STUDY

Present study will be conducted on 90 high schoolers of two schools of D.E.I., Agra. Schools will be selected using purposive sampling. The sample will be divided into three groups - two experimental groups (experimental group I, and experimental group II) and one active control group. Each group will be consisted of 30 students or high schoolers. These groups will be formed using simple random sampling. Participants will be assessed for baseline measures of mind wandering, cognitive ability and metacognition. The age range of participants will be 13 to 16 years. Training of FAM and OMM will be provided to the participants of experimental group I and experimental group II, respectively. Students will practice these two meditation practices under the supervision of expert for 15 minutes a day, three days in a week for 20 weeks in morning before assembly. Participants in active control group will sit quietly for the same duration. After the 20 weeks of training all the three groups will be assessed for mind wandering, cognitive ability, metacognition and event related brain dynamics to examine the effectiveness of interventions. Details of the intervention programmes are given in succeeding sections.

13.1 Focused Attention Meditation Training

For focused attention meditation, the participants will be trained for practice of first stage of *Surat-Shabd-Yoga* Meditation based on Oriental Philosophy of Saints (Radhasoami Philosophy). The participants will practice the repetition of sound Ra-dha-soa-mi at four chakras navel, heart, throat and eye centre respectively. The participants of experimental group I will be exposed to this practice. It will be practiced by participants (N=30) under the supervision of expert for 15 minutes a day, three alternate days in a week for 20 weeks in morning before assembly.

13.2 Open Monitoring Meditation Training

For Open Monitoring meditation, the participants will be trained for practice the practice of Mindfulness Meditation. The mindfulness meditation practice will involve a course of guided breath awareness, sitting meditation which includes becoming aware of automatic or unintentional thoughts or feelings and letting these distractions pass. It will be practiced by participants (N=30) of experimental group II, under the supervision of expert for 15 minutes a day, three alternate days in a week for 20 weeks in morning before assembly hour.

14.0 TOOLS / MEASURES

The following tools or measures will be used for collection of data:

Thought Sampling for the Assessment of Mind Wandering: For the assessment of mind wandering Thought Sampling will be used (Teasdale, 1995). Thought Sampling will be used to examine the attention of participants during the performance of the tasks. Thought sampling is one of the common methods for measuring mind wandering, assessing the inner experience of an individual as they complete a task in a controlled experimental setting (Smallwood, & Schooler, 2006). In this method participants are interrupted to report their experiences during task performance. The responses of participants will be collected at random or quasi-random times during a task performance using questionnaire measures of off- task thinking (Smallwood, O'Connor, et al., 2004). Mind -wandering Questionnaire (MWQ) designed by Mrazek, Phillips, Franklin, Broadway, & Schooler (2013) will be used for the collection of responses of participants. The responses of participants will be recorded and coded using criteria defined by Smallwood, Obomsawin, & Reid (2003).

Performance Tasks for Cognitive ability: **Performance Tasks for Cognitive ability**: For the assessment of cognitive ability different automated computerized form of standard cognitive

assessment tasks are selected, which aim to assess different mental capabilities of children. These tasks are as follows: Eriksen Flanker test (Eriksen, 1974), Stroop test (Stroop, 1935), working memory n- back test (Kirchner, 1958), and PASAT (Paced Auditory Serial Addition Test).

EEG/MEG for the measurement of Event related Brain Dynamics: For the measurement of event related brain dynamics Electroencephalography (EEG) or Magnetoencephalography (MEG) will be used. EEG and MEG are neuroimaging techniques which are used for mapping brain activities. Electroencephalography is an electro-physiological monitoring method which is used to detect brain activities using electric field. EEG detects voltage fluctuations resulting from activities of neurons in brain (Niedermeyer, & da Silva, 2004). On the other hand, Magnetoencephalography uses magnetic field to detect neural activities in the brain. Both EEG and MEG techniques are used to map brain activities. (Hämäläinen, Hari, Ilmoniemi, Knuutila, Lounasmaa, 1993). EEG/ MEG will be used to detect event related brain dynamics of high schoolers.

15.0 STATISTICAL TECHNIQUE

In the present study statistical techniques like Mean, Standard Deviation, and variance are used for description of data. Analysis of variance will be used to find out the effect of FAM and OMM practices on mind wandering, cognitive ability, and event related brain dynamics of high schoolers. t- Test and Analysis of Variance will be used to find out the comparative effect of FAM and OMM practices on mind wandering, cognitive ability, and event related brain dynamics of high schoolers.

16.0 SIGNIFICANCE OF THE STUDY

India is one of the fastest growing and developing country. India is developing in many areas and sectors like science, technology, communication, education, and health care etc. But still it is suffering from problems like poverty, corruption, illiteracy, population explosion pollution and

discrimination. And in order to make India as a developed country it is necessary to sort these problems out. India needs inculcation of feeling of unity, purity, fraternity and justice among its citizens. It needs skilled manpower, educators, developers, higher order thinkers, innovators and effective social engineers.

We are living in the age of accelerating change and super complexity, which is straining out physical defense and overwhelming our decisional process in this situation science of consciousness and meditation can help students and communities for better performance and development and can help society to reach at its better place or condition. The effectiveness of the students mainly depends upon the character, ability, potentiality and its attitude towards learning our conscious experiences are important human trait or characteristics which contributes to learning, problem solving, reasoning, thinking, and over all development of personality.

The purpose of present study is to investigate the effect of focus attention and open monitoring meditation practices on mind wandering cognitive ability, and event related brain dynamics of High school students. The study will also aim to compare the individual effects of focus attention and open monitoring meditation practices on mind wandering, cognitive ability, and event related brain dynamics of High schoolers.

REFERENCES

Ahuja, S. (2014). Effect of Yoga & Meditation on Consciousness & Mindfulness. Journal of Consciousness Exploration & Research, Vol. 5. Issue 5. pp. 434-447

Andresen, J. (2002). Meditation meets behavioral medicine; The story of experimental research on meditation. Journal of Consciousness Studies. 7 (11-12), 17-74.

Anderson, J. (2000). Meditation meets behavioral medicine: The story of experimental research on meditation. Journal of consciousness studies, 7, 17-73. https://tricycle.org/trikedaily/researchers-point-three-major-categories-meditation/

Albrecht, N. J. (2018). Teachers teaching mindfulness with children: Being a mindful role model. Aust JTeach Ed.; 43: 23.

Baranski, M. F. S. (2018). Can Mindfulness Meditation Improve Short-Term and Long-Term Academic Achievement? https://doi.org/10.17605/OSF.IO/3Z7DW

Baranski, M., & Was, C. (2019). Can Mindfulness Meditation Improve Short-term and Long-term Academic Achievement in a Higher-education Course? *College teaching.* DOI - 10.1080/87567555.2019.1594150

Bazzano, A. N., Anderson, C. E., Hylton, C., & Gustat, J. (2018). Effect of mindfulness and yoga on quality of life for elementary school students and teachers: Results of a randomized controlled school-based study. Psychology Research and Behavior Management, 11, Article ID 81-89. http://dx.doi.org/10.2147/PRBM.S157503

Bateson, M., Healy, S. D., & Hurly, T. A. (2003). Context-dependent foraging decisions in rufous hummingbirds. Proceedings. Biological sciences, 270(1521), 1271–1276. doi:10.1098/rspb.2003.2365

Black, D.S., & Fernando, R. (2014). Mindfulness Training and Classroom Behavior Among Lower-Income and Ethnic Minority Elementary School Children. Journal of Child and Family Studies, 23, 1242-1246.

Blackwood, D. H., & Muir, W. J. (1990). Cognitive brain potentials and their application. The British Journal of Psychiatry, 157(Suppl 9), 96-101.

Borquist, C., Debra, S., Maynard, Brandy, R., Brendel, Kristen, E., Farina, Anne S. J. (2019). Mindfulness-Based Interventions for Youth with Anxiety: A Systematic Review and Meta-Analysis. Retrieved from. https://doi.org/10.1177/1049731516684961

Braboszcz, C., Cahn, B. R., Levy, J., Fernandez, M., & Delorme, A. (2017). Increased gamma brainwave amplitude compared to control in three different meditation traditions. PLOS ONE, 12(1). Article e0170647.

Brandmeyer, T. and Delorme, A. (2018). Reduced mind wandering in experienced meditators and associated eeg correlates. Experimental brain research, 236(9):2519– 2528.

Brooks, & Holdnac. (2013). The Prerequisites for Successful Teaching and Learning of Literacy. *European Journal of Education, Research and Development.*, 48 (4): 557-569. https://doi.org/10.1111/ejed.12049.

Burdett, B. R. D., Charlton, S. G., & Starkey, N. J. (2016). Not all minds wander equally: The influence of traits, states and road environment factors on self-reported mind wandering during everyday driving. Accident; Analysis and Prevention, 95, 1–7. http://dx.doi.org/10.1016/j.aap .2016.06.012

Bush, M. (2006). Foreword. Teachers College Record, 108(9), 1721–1722.

Burke, C. (2010). Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. Journal of Child and Family Studies, 19, 133–144. doi:10.1007/s10826-009-9282-x.

Cahn BR, Polich J (2006) Meditation states and traits: EEG, ERP, and neuroimaging studies. Psychol Bull 132: 180–211.

Campos, D., et al. (2019). Exploring the Role of Meditation and Dispositional Mindfulness on Social Cognition Domains: A Controlled Study. Frontiers in psychology, 10, 809. doi:10.3389/fpsyg.2019.00809

Cardoso R, De Souza E, Camano L, et al. (2004). Meditation in health: an operational definition. Brain Research Protocols, 14, 58-60.

Carmody, J., & Baer, R. A. (2009). How long does a mindfulness-based stress reduction program need to be? A review of class contact hours and effect sizes for psychological distress. *Journal of Clinical Psychology*, *65*, 627–638.

Carpena, M.X., Tavares, P.D., & Menezes, C.B. (2019). The effect of a six-week focused meditation training on depression and anxiety symptoms in Brazilian university students with 6 and 12 months of follow-up. Journal of affective disorders, 246, 401-407.

Carroll .1992, Human cognitive abilities: A survey of factor-analytic studies, Cambridge University Press, New York, NY, USA.

Ching, H. H., Koo, M., Tsai, T. H., & Chen, C. Y. (2015). Effects of a Mindfulness Meditation Course on Learning and Cognitive Performance among University Students in Taiwan. Evidence-based complementary and alternative medicine: eCAM, 2015, 254358. doi:10.1155/2015/254358

Corsi, P.M. (1972). Human memory and the medial temporal region of the brain. Doctoral Thesis at McGill University (Canada).

Creswell, J. D., Irwin, M. R., Burklund, L. J., Lieberman, M. D., Arevalo, M. G., Ma, J. Cole, S. W. (2012). Mindfulness-based stress reduction training reduces loneliness and proinflammatory gene expression in older adults: A small randomized controlled trial. Brain, Behavior, & Immunity, 26, 1095-1101

Daya, & Hearn. (2017). Mindfulness interventions in medical education: A systematic review of their impact on medical student stress, depression, fatigue and burnout. 40:2, 146-153, DOI: 10.1080/0142159X.2017.1394999

Deans, A. (2019). Quiet Time based on Transcendental Meditation. *David Lynch Foundation programs for schools.* Retrieved from: https://www.davidlynchfoundation.org

Dahl, C. J., Lutz, A., & Davidson, R. J. (2015). Reconstructing and deconstructing the self: cognitive mechanis. ms in meditation practice. Trends in cognitive sciences, 19(9), 515–523. doi:10.1016/j.tics.2015.07.001

Davis, et al. (2014) Randomized Trial on Mindfulness Training for Smokers Targeted to a Disadvantaged Population, Substance Use & Misuse, 49:5, 571-585, DOI: 10.3109/10826084.2013.770025

Daya, Z., & Hearn, J. H. (2018) Mindfulness interventions in medical education: A systematic review of their impact on medical student stress, depression, fatigue and burnout, Medical Teacher, 40:2, 146-153, DOI: 10.1080/0142159X.2017.1394999

Eberth, J., & Sedlmeier, P. (2012). The effects of mindfulness meditation: A meta-analysis. Mindfulness, 3(3), 174-189. http://dx.doi.org/10.1007/s12671-012-0101-x

Eriksen, B. A.; Eriksen, C. W. (1974). "Effects of noise letters upon identification of a target letter in a non- search task". Perception and Psychophysics. 16: 143–149. doi:10.3758/bf03203267

Flavell, J. H., & Wellman, H. M. (1977). Metamemory. In R. Kail & J. Hagen (Eds), Perspectives on the development of memory and cognition. Hillsdale, NJ: Erlbaum

Franco, C., Mañas, I., Cangas, AJ., Moreno, E., Gallego, J. (2016). Reducing teachers' psychological distress through a mindfulness training program. The Spanish Journal of Psychology. Vol. 13 No. 2, 655-666. https://www.ncbi.nlm.nih.gov/pubmed/20977015

Franco C, et al. (2010). Knowledge Management, Information Systems, E-Learning, and Sustainability Research. The applications of mindfulness with students of secondary school: Results on the academic performance, self-concept and anxiety; pp. 83–97. [Google Scholar]

Galante, et al. (2017). A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial. DOI:https://doi.org/10.1016/S2468-2667(17)30231-1

Garland, E. L., Manusov, E. G., Froeliger, B., Kelly, A., Williams, J. M., & Howard, M. O. (2014). Mindfulness-oriented recovery enhancement for chronic pain and prescription opioid misuse: results from an early-stage randomized controlled trial. *Journal of consulting and clinical psychology*, *82*(3), 448–459. doi:10.1037/a0035798

Gazzaniga, M. S. (1995). Principles of human brain organization derived from split-brain studies. Neuron, 14(2), 217–228. https://doi.org/10.1016/0896-6273(95)90280-5

Giovanni, D., (2019). Master your Mind. https://makemindpowerful.com/master-mind-giovanni-dienstmann/

Goldberg, S.B., R.P. Tucker, P.A. Greene, et al. 2018. Mindfulness-based interventions for psychiatric disorders: a systematic review and meta-analysis. Clin. Psychol. Rev. 59: 52–60.

Goldshmidt, G. (2019). Meditation with Children Is It Appropriate to Do Reflective and Meditative Activity with Children in Schools?, Religion & Education, DOI: 10.1080/15507394.2019.1590942

Goyal, M., Singh, S., Sibinga, E. M. S., Gould, N. F., Rowland-Seymour, A., Sharma, R., … Haythornthwaite, J. a. (2014). Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. JAMA Internal Medicine, 174(3), 357–68. https://doi.org/10.1001/jamainternmed.2013.13018

Graham, A. & Truscott, J. (2019). Exploring mystery: can Christian meditation at school nurture students' relationships with God?, *Journal of Beliefs & Values*, DOI: 10.1080/13617672.2019.1611070

Grandchamp, R., Braboszcz, C., & Delorme, A. (2014). Oculometric variations during mind wandering. Frontiers in psychology, 5, 31. doi:10.3389/fpsyg.2014.00031

Greenberg, J., Romero, V. L., Elkin-Frankston, S., Bezdek, M. A., Schumacher, E. H. & Lazar, S. W. (2018). Reduced interference in working memory following mindfulness training is associated with increases in hippocampal volume, Brain Imaging and Behavior, 1-11, https://doi.org/10.1007/s11682-018-9858-4

Gronwall, D. (1977). Paced Auditory Serial-Addition Task: A measure of recovery from concussion. Perceptual and Motor Skills, 44, 367–373

Hämäläinen M, Hari R, Ilmoniemi RJ, Knuutila J, Lounasmaa OV (1993). "Magnetoencephalography—theory, instrumentation, and applications to noninvasive studies of the working human brain" (PDF). Reviews of Modern Physics. 65 (2): 413–497. Bibcode:1993RvMP...65..413H. doi:10.1103/RevModPhys.65.413. ISSN 0034-6861

Harnett, P.S. and Dawe, S. (2012) Review: The contribution of mindfulness--based therapies for children and families and proposed conceptual integration. Child and Adolescent Mental Health (accepted for publication).

Harne, B.P., Hiwale, A.S. (2018). EEG spectral analysis on OM mantra meditation: a pilot study. *Appl Psychophysiol Biofeedback*, 43:123-129.

Healy, R.L., & Hurly, G.L. (2003). The Spectrum of Social Cognition. DOI: 10.1016/B978-1-4160-3370-7.00038-9

Hj Ramli, N. H., Alavi, M., Mehrinezhad, S. A., & Ahmadi, A. (2018). Academic Stress and Self-Regulation among University Students in Malaysia: Mediator Role of Mindfulness. Behavioral sciences (Basel, Switzerland), 8(1), 12. doi:10.3390/bs8010012

Hofmann, S., G., Sawyer, A. T,m Witt, A. A., & Oh, D. (2010). Effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. Journal of Consulting and Clinical Psychology, 78, 169-183.

Hölzel et al (2011) Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Research Neuoroimaging191 (1): 36 DOI: 10.1016/j.pscychresns.2010.08.006.

Ispas, D., & Borman, W. C. (2008). Beyond task performance: The concept of organizational citizenship performance. Psihologia Resurselor Umane Revista Asociaţiei de Psihologie Indusstrială şi Organizaţională, 6(1), 12-18.

Jha, A., Krompinger, J., & Baime, M. J. (2006). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience, 7,* 109–119.

Joice, S.P. (2016). Interventions to Improve Cognitive Interventions to Improve Cognitive Function and Academic Performance of Medical Students (Doctoral Dissertation, Vinayaka Missions University).

Kaur C, Singh P. (2015). EEG derived neuronal dynamics during meditation: progress and challenges. Advances in Preventive Medicine 2015 Article 614723.

Karunananda, A.S., Goldin, P.R., & Talagala, P.D. (2016). Examining Mindfulness in Education.

Keating, N. (2017). Children's spirituality and the practice of meditation in Irish primary schools. *International Journal of Children's Spirituality*, 22:1, 49-71, DOI: 10.1080/1364436X.2016.1264928

Khoury, B., Sharma, M., Rush, S. E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. Journal of Psychosomatic Research, 78, 519- 528.

Kim B.-N., Cho S.-C., Kim Y., Shin M.-S., Yoo H.-J., Kim J.-W., Yang Y.H., Hong Y.-C. (2009) Biological Psychiatry, 66 (10), pp. 958-963.

Kirchner, W. K. (1958). "Age differences in short-term retention of rapidly changing information". Journal of Experimental Psychology. 55 (4): 352–358. doi:10.1037/h0043688.

Klimes et al. (2019). Transcendental meditation and hypothalamic-pituitary-adrenal axis functioning: a pilot, randomized controlled trial with young adults. *The International Journal on the Biology of Stress.* doi: 10.1080/10253890.2019.1656714.

Kristeller, J., Wolever, R.Q., & Sheets, V. (2014). Mindfulness-Based Eating Awareness Training (MB-EAT) for Binge Eating: A Randomized Clinical Trial. *Mindfulness, 5*, 282-297.

Kudesia, R. S. (2019) (in press). Mindfulness as metacognitive practice. Academy of Management Review. https://doi.org/10.5465/amr.2015.0333.

Lenz, A. S., Hall, J., & Bailey Smith, L. (2016). Meta-analysis of group mindfulness-based cognitive therapy for decreasing symptoms of acute depression. The Journal for Specialists in Group Work, 41(1), 44-70. doi:10.1080/01933922.2015.1111488

Lin, I. W., & Mai. L. J. (2018). Impact of mindfulness meditation intervention on academic performance. *Innovations in Education and Teaching International*, 55:3, 366-375, DOI: 10.1080/14703297.2016.1231617

Lippelt, D., Hommel, B., Colzato, LS. (2014). Focused attention, open monitoring and loving kindness meditation: effects on attention, conflict monitoring, and creativity - A review. Frontiers in Psychology. https://doi.org/10.3389/fpsyg.2014.01083

Lubar, J. F. (1997). Neocortical dynamics: Implications for understanding the role of Neurofeedback and related techniques for the enhancement of attention. Applied Psycho-physiology and Biofeedback, 22, 111- 126.

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. Trends in Cognitive Science, 12, 163-169. doi: 10.1016/j.tics.2008.01.005.

Lynch et al. Mantra meditation for mental health in the general population: A systematic review. *European Journal of Integrative Medicine*, 23, 101-108. https://doi.org/10.1016/j.eujim.2018.09.010

Manna, A., Raffone, A., Perrucci, M. G., Nardo, D., Ferretti, A., Tartaro, A., et al. (2010). Neural correlates of focused attention and cognitive monitoring in meditation. Brain Res. Bull. 82, 46–56. doi: 10.1016/j.brainresbull.2010.03.001

Mori. E. S. (2018). The Effect of Mindful Practices on the Independent Learning Process of Third-Grade Montessori Students (Doctoral Dissertation, University of South Carolina). Retrieved from: https://search.proquest.com/docview/2128177975

Moye, A.S., & Vugt, M.K. (2017). A computational model of focused attention meditation and its transfer to a sustained attention task.

Maynard, B.R., Solis, M., Miller, V.L., & Brendel, K.E. (2017). Mindfulness-Based Interventions for Improving Cognition, Academic Achievement, Behavior, and Socioemotional Functioning of Primary and Secondary School Students. Campbell Systematic Reviews 2017:5.

Mrazek, M. D., Phillips, D. T., Franklin, M. S., Broadway, J. M., & Schooler, J. W. (2013). Young and restless: validation of the Mind-Wandering Questionnaire (MWQ) reveals disruptive impact of mind-wandering for youth. Frontiers in psychology, 4, 560. doi:10.3389/fpsyg.2013.00560

Niessing, J., Ebisch, B., Schmidt, K.E., Niessing, M., Singer, W., & Galuske, A. (2005). Hemodynamic signals correlate tightly with synchronized gamma oscillations. Science, 309 5736, 948-51.

Niileksela, C. R., Reynolds, M. R., Keith, T. Z., & McGrew, K. S. (2016). A special validity study of the Woodcock-Johnson IV: Acting on evidence for specific abilities. In D. P. Flanagan & V. C. Alfonso (Eds.), WJ IV clinical use and interpretation: Scientist-practitioner perspectives (pp. 65-106). San Diego, CA, US: Elsevier Academic Press

Niedermeyer E.; da Silva F.L. (2004). Electroencephalography: Basic Principles, Clinical Applications, and Related Fields. Lippincott Williams & Wilkins. ISBN 978-0-7817-5126-1

Norris, C. J., Creem, D., Hendler, R., & Kober, H. (2018). Brief Mindfulness Meditation Improves Attention in Novices: Evidence From ERPs and Moderation by Neuroticism. Frontiers in human neuroscience, 12, 315. doi:10.3389/fnhum.2018.00315

Nyhus E, Engel WA, Pitfield TD and Vakkur IMW (2019) Increases in Theta Oscillatory Activity During Episodic Memory Retrieval Following Mindfulness Meditation Training. Front. Hum. Neurosci. 13:311. doi: 10.3389/fnhum.2019.00311

O'Driscoll, M., Byrne, S., Gillicuddy, A.M., Lambert, S., & Sahm, L.J. (2017). The effects of mindfulness-based interventions for health and social care undergraduate students - a systematic review of the literature. Psychology, health & medicine, 22 7, 851-865.

Online Etymology Dictionary, Douglas, H. (2019). Meditation. https://www.etymonline.com/word/meditation#etymonline_v_12520. Retrieved on 2 February 2019.

Pradhan, S., Ajithkumar, V. V. (2018). Mindfulness interventions in medical education: A systematic review of their impact on medical student stress, depression, fatigue and burnout. Retrieved from: https://www.vridhamma.org

Pagnoni, G., Cekic, M., & Guo, Y. (2008). "Thinking about Not-Thinking": Neural Correlates of Conceptual Processing during Zen Meditation. *PLoS ONE, 3*, 44 - 46.

Patton, K. A., Connor, J. P., Sheffield, J., Wood, A., & Gullo, M. J. (2019). Additive effectiveness of mindfulness meditation to a school-based brief cognitive–behavioral alcohol intervention for adolescents. Journal of Consulting and Clinical Psychology, 87(5), 407-421. http://dx.doi.org/10.1037/ccp0000382

Penny, W. D., Kiebel, S. J., Kilner, J. M., & Rugg, M. D. (2002). Event-related brain dynamics. Trends in Neurosciences, 25(8), 387-389. http://dx.doi.org/10.1016/S0166-2236(02)02202-6

Raldiris, T.L. (2017). Focused Attention vs. Open Monitoring: An Event-Related Potential Study of Emotion Regulation by Two Distinct Forms of Mindfulness Meditation.

https://www.semanticscholar.org/paper/Focused-Attention-vs.-Open-Monitoring%3A-An-Potential-Raldiris/41f246e03682d04a52f0909ae4089bf38b7a9188

Ramsburg, J., & Youmans, R.J. (2014). Meditation in the Higher-Education Classroom: Meditation Training Improves Student Knowledge Retention during Lectures. Mindfulness, 5, 431-441.

Sahab, M. (Mishra B.S.). (1909). Discourses on Radhasoami Faith (with supplement). Edition 2009. Radhasoami Satsang Sabha, Dayalbagh, Agra.

Salinas, E., Sejnowski, T.J., 2001. Correlated neuronal activity and the flow of neural information. Nat. Rev., Neurosci. 2 (8), 539–550.

Satsangi, P.S. (2011). Speech Published in Prem Pracharak. Agra: Dayalbagh Press & Publication(P), Ltd. 90 (6)

Saltzman, A. (2014). *A Still Quiet Place: A Mindfulness Program for Teaching Children and Adolescents to Ease Stress and Difficult Emotions.* Oakland, CA: New Harbinger Publications

Scheibner, H. J., Bogler, C., Gleich, T., Haynes, J. D., & Bermpohl, F. (2017). Internal and external attention and the default mode network. NeuroImage,148(September 2016), 381–389. https://doi.org/10.1016/j.neuroimage.2017.01.044

Segal Z. V., Teasdale J. D., Williams J. M., & Gemar M. C. (2002). The Mindfulness-Based Cognitive Therapy Adherence Scale: Interrater reliability, adherence to protocol and treatment distinctiveness. Clinical Psychology and Psychotherapy, 9, 131–138. [Google Scholar]

Segal Z. V., Williams J. M. G., & Teasdale J. D. (2002). Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse. New York: Guilford. [Google Scholar]

Shadiev, R., & Huang, Y. M. (2019) Investigating student attention, meditation, cognitive load, and satisfaction during lectures in a foreign language supported by speech-enabled language translation, Computer Assisted Language Learning, DOI: 10.1080/09588221.2018.1559863

Shapiro, S. L., Brown, K. W., and Astin, J. A. (2008). *Toward the Integration of Meditation Into Higher Education: A Review of Research*. Prepared for the Center for Contemplative Mind in Society. Unpublished research report.

Shapiro, S. L., Brown, K. W., and Biegel, G. M. (2007). Teaching self-care to caregivers: effects of mindfulness-based stress reduction on the mental health of therapists in training. *Train. Educ. Prof. Psychol*. 1, 105–115. doi: 10.1037/1931-3918.1.2.105

Shapiro, S. L., Brown, K. W., and Astin, J. A. (2011). *Toward the Integration of Meditation Into Higher Education: A Review of Research*. Prepared for the Center for Contemplative Mind in Society. Unpublished research report.

Singer, W. (1999). Neuronal synchrony: a versatile code for the definition of relations? Neuron 24,. DOI: https://doi.org/10.1016/S0896-6273(00)80821-1

Singh, N., & Telles, S. (2015). Neurophysiological Effects of Meditation Based on Evoked and Event Related Potential Recordings. BioMed research international, 2015, 406261. doi:10.1155/2015/406261

Singleton, O. et al. 2014. Change in brainstem gray matter concentration following a mindfulness-based intervention is correlated with improvement in psychological well-being. Front. Hum. Neurosci. 8: 33

Slagter HA, Lutz A, Greischar LL, Francis AD, Nieuwenhuis S, et al. (2007) Mental Training Affects Distribution of Limited Brain Resources . PLOS Biology 5(6): e138. https://doi.org/10.1371/journal.pbio.0050138

Slaviero, T.M. (2017). The impact of guided meditation on children's behaviour, mental health and well-being.

Smallwood, J., Obonsawin, M. C., & Reid, H. (2003). The effects of blockduration and task demands on the experience of task-unrelated-thought. Imagination, Cognition and Personality, 22, 13–31.

Smallwood, J., O'Connor, R. C., Sudberry, M. V., & Ballantyre, C. (2004). The consequences of encoding information on the maintenance of internally generated images and thoughts: The role of meaning complexes. Consciousness and Cognition, 4, 789 – 820.

Smallwood and Schooler. (2006). The restless mind. Psychological Bulletin

Sapthiang, S., Van Gordon, W. & Shonin, E. (2018). Mindfulness in schools: A health promotion approach to improving adolescent mental health. International Journal of Mental Health and Addiction, Epub ahead of print. doi: 10.1007/s11469-018-0001-y

Spadaro, K.C., & Hunker, D.F. (2016). Exploring The effects Of An online asynchronous mindfulness meditation intervention with nursing students On Stress, mood, And Cognition: A descriptive study. Nurse education today, 39, 163-9.

Srinivasan. 2019. Meditation, V&S PublishersVol. 250, 1st Ed. Retrieved from. https://www.elsevier.com/books/meditation/srinivasan/978-0-444-64227-1

Stein, A.V., & Sarnthein, J. (2000). Different frequencies for different scales of cortical integration: from local gamma to long range alpha/theta synchronization. International journal of

psychophysiology: official journal of the International Organization of Psychophysiology, 38 3, 301-13.

Strickland, K., & Salwyn, J. (2019). Effects of a Short Mindfulness Meditation on Cognitive Function. Sentience: The University of Minnesota Undergraduate Journal of Psychology, Vol.18, 1-4.

Stroop, John Ridley (1935). "Studies of interference in serial verbal reactions". Journal of Experimental Psychology. 18 (6): 643–662. doi:10.1037/h0054651. hdl:11858/00-001M-0000-002C-5ADB-7

Sur, S., & Sinha, V.K. (2009). Event-related potential: An overview. Industrial psychiatry journal.

Tang. Y, Tang, Y. Y., Qilin, L., Gen, X., Stein, E. A., Yang, Y., and Posner, M. I. (2017). Shortterm meditation induces white matter changes in the anterior cingulate. Proc.

Teasdale, J. D., Dritschel, B. H., Taylor, M. J., Proctor, L., Lloyd, C. A., Nimmo-Smith, I., et al. (1995). Stimulusindependent thought depends on central executive resources. Memory and Cognition, 23(5), 551-559.

Telle S., Raghavendra B.R., Naveen K.V., Manjunath N.K., Subramanya P. (2012). Mid-latency auditory evoked potentials in 2 meditative states. Clin EEG Neurosci. ;43:154–160. [PubMed] [Google Scholar]

Telles S., Raghavendra B.R., Naveen K.V., Manjunath N.K., Kumar S., Subramanya P. (2013). Changes in autonomic variables following two meditative states described in yoga texts. J Altern Complement Med.;19: 35–42. [PMC free article] [PubMed] [Google Scholar]

Telles S., Singh D., Naveen K.V., Pailoor S. (2015). Long latency auditory evoked potentials during meditation. Clin EEG Neurosci. ;46: 299–309. [PubMed] [Google Scholar]

Telles, S., Singh, N., Gupta, R. K., & Balkrishna, A. (2016). A selective review of dharana and dhyana in healthy participants. *Journal of Ayurveda and integrative medicine*, *7*(4), 255–260. doi:10.1016/j.jaim.2016.09.004

Thatcher, Robert. (1998). Normative EEG databases and EEG biofeedback. Journal of Neurotherapy. 2. 8-39. 10.1300/J184v02n04_02.

Travis et al., 2018. Effect of meditation on psychological distress and brain functioning: A randomized controlled study. *Brain and Cognition,*Vol. 125, 100-105. https://doi.org/10.1016/j.bandc.2018.03.011

Valosek et al. (2019). Effect of Meditation on Social-Emotional Learning in Middle School Students. *Education, 139 (3),* 111-169.

Waters, L., Barsky, A., Ridd, A., & Allen, K. (2015). Contemplative Education: A Systematic, Evidence-Based Review of the Effect of Meditation Interventions in Schools. Educational Psychology Review, 27, 103-134. http://dx.doi.org/10.1007/s10648-014-9258-2

Waters, L ., Barsky, A., Ridd, A., & Allen, K. (2014). Contemplative Education: A Systematic, Evidence-Based Review of the effect of Meditation Interventions in Schools. Educational Psychology Review (2015) 27: 103. https://doi.org/10.1007/s10648-014-9258-2

Weare, K. (2018). The Evidence for Mindfulness in Schools For Children and Young People.

Wilson, G. (2019). Improving Behaviour By Implementing In-School Meditation/Mindfulness Interventions. (Action Research Report, Department of Education, Goucher College). Retrieved From: http://hdl.handle.net/11603/13804

Wimmer, L.F., Bellingrath, S., & Stockhausen, L.V. (2016). Cognitive Effects of Mindfulness Training: Results of a Pilot Study Based on a Theory Driven Approach. Front. Psychol..

Wisner B.L. (2017) Mindfulness and Meditation for Adolescents in Educational Settings. In: Mindfulness and Meditation for Adolescents. Palgrave Macmillan, New York. https://doi.org/10.1057/978-1-349-95207-6_4

Woodword, D. (2019). Teacher Perceptions of Mindfulness Implementation in Public Schools. *Yale University Report.* Retrieved from: https://educationstudies.yale.edu

Wendt, S., Hipps, J., Abrams, A.I., Grant, J., Valosek, L., & Nidich, S. (2015). Practicing Transcendental Meditation in High Schools: Relationship to Well-being and Academic Achievement Among Students. Contemporary School Psychology, 19, 312-319.

Xu, et al. (2016). Relation of perceptions of educational environment with mindfulness among Chinese medical students: a longitudinal study. Medical education online, 21, 30664. doi:10.3402/meo.v21.30664